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February 19, 1996

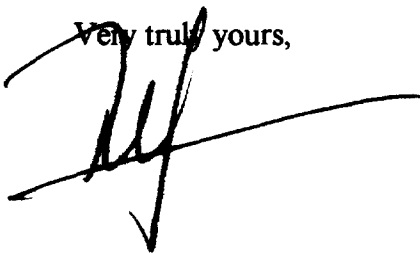
William Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W.
Washington, D.C. 20554

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Dear Mr. Caton:

Enclosed are the Original and four (4) copies, plus five (5) copies for the Chairman and Commissioners, of an initial response to WT 96-6.

Very truly yours,



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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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|--|---|-------------------|
| Comments on |) | |
| WT Docket 96-006 |) | February 26, 1996 |
| Amendment to the Commissions Rules |) | |
| To Permit Flexible Service Offerings |) | |
| in the Commercial Radio Services |) | |
| Comments From |) | |
| COMAV, LLC and The Telmarc Group, Inc. |) | |

**NOTICE OF PUBLIC RULE MAKING
RESPONSE**

1. SUMMARY

The Commission has requested comments on its Notice of Public Rule Making ("NPRM") regarding Docket WT 96-6 relating to the ability of CMRS providers to provide fixed services and other such services as may make them a local exchange carrier. COMAV is a wireless telecommunications provider with operations in the Commonwealth of Massachusetts and The Telmarc Group ("Telmarc") is in the provision of various wireless services and was a petitioner in the Pioneer Preference Filings before the Commission, as well as the holder of various Experimental Licenses from the Commission and has been an applicant for and has received through a former subsidiary, Telmarc Telecommunications, Common Carrier Certification as a wireless local exchange carrier in the Commonwealth of Massachusetts, the first such assignment to have been made in the United States.

COMAV and Telmarc, collectively called the "Respondent", seeks to provide the Commission with its perspective regarding the nature of the CMRS providers and their ability to provide fixed services. Specifically, the Respondent seeks the Commission to take note of two facts and the resulting conclusion:

Fact 1: Due to the current tariffs as they are today in the area of Washington, DC, the costs of a business telephone call from Sterling, VA to the District of Columbia, during business hours, is \$0.45 per minute. The cost of the same call by means of a wireless carrier, APC, is \$0.35 per minute. The business customers in this part of Virginia are now using wireless to connect between Virginia and the District because of price differential.

The customers have commoditized the service offering and have selected based solely on the efficiencies of the market pricing mechanism. This simple example of the concept of displacement in a commodicizable market.

Fact 2: The Customer cannot be mandated to use a wireless telephone in a fashion proscribed by law. The early introduction of MCI services allowing any user via an access code found ways to place long distance calls via the complex access codes despite the attempts by the Commission to mandate otherwise.

Conclusion: A wireless telephone is used in a fashion that is mandated by the market and as technology improves, as it is wont to do, then clearly the use will be in a displacement mode with local exchange fixed service.

The Respondent takes the position that the free markets shall determine the use of wireless depending upon price, quality and technology, and that such a choice is consistent with the 1996 Act and that the issue of allowing or regulating CMRS applications is a futile task. Thus the Respondent takes the position that the Commission should establish a "hands off" approach to CMRS usage. The Respondent has filed and published many analyses relating to this area and brings these to the attention of the Commission as part of this filingⁱ, ⁱⁱ.

The Respondent has repeatedly argued that there should no distinction made between the CMRS and the LEC and that all parties providing the equivalent of local telecommunications service should be treated pari passu. In effect there are multiple LECs in any one market and that the technological distinctions made as a basis of service

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2. BACKGROUND

The provision of wireless telecommunications services is essential the provision of local exchange service. The service offering is that of a wireless toll grade voice or data service provided through a seamless interoperable national network service. Simply stated, this is the commoditization of local exchange service. Namely, the wireless operator is offering, from the consumers perspective, the same product as the existing monopoly local exchange carrier.

2.1 PREVIOUS POSITION

The Respondent provided the following definition of PCS in the filing on 90-314 in the initial FCC Docket on PCS:¹

"(i) PCN/PCS is a wireless telecommunications service that provides access to all users, delimited only by coverage or frequency access, allowing at a minimum toll grade quality voice service, and access to a wide variety of other voice and data services, provided either through the new PCN network or using existing or to be developed service providers, extra the network. The service should allow seamless national capability that is transparent to the user and the service must be provided on a highly cost effective basis that allows universal access."

and also:

"THE GOAL OF THE ESTABLISHMENT OF NEW PCN SERVICES IS TO PROVIDE TO THE PUBLIC, SEAMLESS AND INTEROPERABLE WIRELESS TELECOMMUNICATIONS SERVICES THAT USE THE MOST INNOVATIVE TECHNOLOGY AND TECHNIQUES AND PROVIDED IN AS COMPETITIVE ENVIRONMENT AS POSSIBLE, TO ENSURE THE MAXIMUM BENEFIT TO THE CONSUMER IN THE SHORTEST TIME."

The Respondent then subsequently made the following statements in the Matter of Implementation of Sections 3(n) and 332 Gen. Docket No. 93-252 of the Communications Act, November 8, 1993:

"The Respondent seeks to clarify the terms provided in the NPRM issued by the Commission. Specifically there are two terms employed with some confusion; Local Exchange Carrier (LEC) and the Public Switched Telephone Network (PSTN). The Definitions suggested are as follows:

¹ Telmarc filing on November 8, 1992 in Docket 90-314.

Definition: The Local Exchange Carrier is any local common carrier who provides end user access in a common carriage fashion, and provides local transport, switching, billing, and interconnections capabilities to other LECs.

Definition: LEC Interconnection is defined as the ability of one LEC to have access to any other LECs network via a set of open, defined, standard, stable and accessible interfaces for the purpose of providing communications parity between the two LEC networks.

Definition: The Public Switched Telephone Network (PSTN) is defined as the collection of all LEC and IEC networks, providing services on a common carriage basis and allowing mutually accessible interconnection capabilities amongst and between them.²

These definitions attempt to clarify a significant set of issues. First it is clear that the term LEC, as applied to the local Bell Operating Companies, BOCs, such as New York Telephone Company, NYT, cannot be solely applied as a term of art in the context of the new competitiveness permitted by PCS. Specifically all local companies, be they wire based on wireless are local exchange carriers. The issue is parity amongst LECs and not the need to establish a preferential treatment to the embedded monopoly player, the BOC.

The PSTN is an amalgam of such entities combined with the IECs and requiring further the need for interconnection. The terms Co Carrier is comparable to that of LEC combined with open interconnect.

The issue of common carriage is one driven by the nature of the offering.³ As a term of art, common carriage implies that the entity intends to offer its services to any and all comers at a publicly posted price per unit of service. Further, the entity will not discriminate amongst any entity that seeks to obtain service in those areas in which the purveyor offers such bundle of services. From a historical perspective, common carriage is embedded in English law allowing shipping firms to use public dock space in return for

² NPRM 93-252, Para 22. The Commission has requested definition of the PSTN. The Respondent notes that such a definition requires a more detailed description at both the physical and logical levels. Also that the PSTN has been changed by technology and the ability to interconnect at all levels. Further, the distinction between voice, data, basic and enhanced is significantly blurred by the use of digital systems and especially multimedia environments.

³ Brenner, Law and Regulation of Common Carriers, Westview, 1992, pp. 35-37. The author states that the Act is ambiguous on common carriage. However, the author states that the statutory elements may be inferred as; engaged in communications, common by holding itself out to the public indiscriminately, a carrier in terms of control the means of transmission, for hire, not broadcasting. Furthermore, it should be noted that common carriage brings rights as well as responsibilities. It does not imply that common carriage is merely a burden.

the commitment to offer to carry any cargo at listed prices. It did not preclude private shipping from firms at their own docks, located on property at their own land.

The issue of common carriage in the post auction environment raises several issues of common law regarding ownership. If the spectrum is auction, does this imply that the winner of the auction has certain common law property rights, albeit an implied renter. If such rights accrue, does the entity yielding such property rights have the right to restrict them post the agreement to buy or rent. As such, can common carriage be imposed ex post facto?

The issue is a policy issue of some import. Does the Commission desire the frequencies being auctioned to be put to the broadest use? Or, is it possible for an exiting competitor to acquire the frequency right, call them private carriage, and remove them from the market. Such would be that actions of a monopolist. Indeed, as has been argued before by the Respondent, the existing monopolist may find it financially advantageous to buy the rights, at prices that are considered by new entrants are irrational bids, but by the monopolist justified by protection of the monopoly rents.

Then the monopolist could sit on those rights until such time as they may be used by the monopolist in a favorable fashion in its monopolistic business. The issue then is that private carriage may convey ability to increase and sustain monopolistic positions. Therefore, the direct and immediate requirement of being a common carrier may avoid such positioning.⁴

The Respondent thus argues that from the perspective of public policy, all PCS spectrum should be used in a common carriage fashion."

2.2 LEC ALTERNATIVES

The Commission has made an implicit assumption that there is a single Local Exchange Carrier in each market and has generally identified that carrier with the RBOC. However, the use of the term Local Exchange Carrier, "LEC", can and should be used in a broader sense. Specifically, the LEC should be any purveyor of local telecommunications access, from the point of access to the customer to the trunk side or interconnection side of the carriers ultimate means for switching between competing LECs, not merely the point at

⁴ ¶ 45, NPRM 93-252. The Commission tentatively concludes that no single regulatory designation should be applied to PCS. The Respondent herein argues that such a designation is against the overall objective of a PCS spectrum allocation that desires to ensure the broadest base of voice and data services available to all of the public. The issue above presented is but one of many that could reduce the public availability of the benefits of such spectrum. In addition, common carriage is a protection offered the public that ensures access to such spectrum.

which the carrier may switch amongst itself⁵. Namely, the LEC, be there one or several, can and should be considered as the totality of the entity that presents itself to the customer as purveyor of services and in turn provides a point for interconnection at a latter location.

The Telecommunications Act of 1996 defines a Local Exchange Carrier as follows⁶:

"Local Exchange Carrier.-The term "local exchange carrier" means any person that is engaged in the provision of telephone service or exchange access. Such term does not include a person insofar as such a person is engaged in the provision of a commercial mobile radio service under section 332(c), except to the extent that the Commission finds that such service should include that the Commission finds that such service should be included in the definition of such term."

The exemption is specifically for CMRS, commercial mobile radio services, which has been defined under section 332 as follows:

*"Section 332(d)(1) provides that a mobile service will be classified as a "commercial mobile radio service" if it meets two criteria: the service 91) is "provided for profit", and (2) makes "interconnected service" available "to the public" or "to such classes of eligible users as to be effectively available to a substantial portion of the public". "Interconnected Service" is defined in Section 332(d)(2) as "service that is interconnected with the public switched network" or service for which an interconnection request is pending under Section 332(c)(1)(B)."*⁷

The operative term is "mobile" which is defined by example as follows:

"Section 20.9 of the Commission's rules defines the mobile services regulated as commercial mobile radio services pursuant to Section 332 of the Communications Act of 1934, as amended, 47 U.S.C. § 332, as follows: Private Paging (Part 90), excluding not for profit paging systems that serve only the licensee's own internal communications needs; Business Radio Services (Part 90) that offer customers for-profit interconnected

⁵ The Respondent seeks to point out that technology is changing so rapidly that with the use and implementation of distributed systems, the concept of switching occurring at some well defined location is no longer reasonable. The Commission has in WT 96-6 both implicitly and explicitly attempted to use this construct. The Respondent strongly urges the Commission to rethink this paradigm as it is no longer viable.

⁶ ¶ 44 of the Telecommunications Act of 1996, the "1996 Act". Note that this has similarities to the 1934 Act defining a Common Carrier which has been almost a circular definition. Here the definition allows the Commission latitude to make it mean whatever it is meant to mean.

⁷ ¶ 10 of GN 93-252 dated October 8, 1993.

*service; Land Mobile Systems on 220-222 MHz (Part 90), except services that are not for profit or do not offer interconnected service; Specialized Mobile Radio Services that provide interconnected service (Part 90); Public Coast Stations (Part 80, subpart J); Public Mobile Service (paging and radiotelephone service and 454 MHz air-ground radiotelephone service) (Part 22, subparts E and G); Cellular Radiotelephone Service (Part 22, subpart H); 800 MHz Air-Ground Radiotelephone Service (Part 22, subpart G); Offshore Radiotelephone Service (Part 22, subpart I); any mobile satellite service involving the provision of CMRS directly to end users, except as exempt under Section 20.9(a)(10); Personal Communications Services (Part 24), except if exempt under Section 20.9(b); for-profit subsidiary communications services transmitted on sub-carriers within the FM baseband signal that provide interconnected service (Part 73); and a mobile service that is the functional equivalent of a commercial mobile radio service. 47 C.F.R. § 20.9."*⁸

The key issue here is a reseller, disaggregator, agent or other similar entity a purveyor of some or part of the services and thus are they then subsumed under the rubric of the CMRS. This will be discussed in the next sub-section. The Commission has further developed a definition of Wireless Local Loop, WLL, which is proposed as follows.

*"Wireless Local Loop as the path between the subscriber and the first point of switching or aggregation of traffic."*⁹

We argue that this definition has fundamental fault since it does not take into account that aggregation or switching takes place in the cell site and may also, depending on the evolution of the technology take place in the end user terminal.

The Respondent has developed a position that strongly argues for the elimination of this distinction between the CMRS and the LEC. Both are purveyors of the same sets of services, the only distinction being the utilization of an FCC issued license for spectrum which is a part, but only a small element, of the overall offering. All entities are competing for the same market, providing the same or similar services, and the Commission should act upon the request of the 1996 Act to find that CMRS is indistinguishable from any other LEC.

2.3 DISAGGREGATION OF NETWORKS

⁸ ¶ 2 of WT 96-6, dated January 25, 1996.

⁹ ¶ 6 of WT 96-6, dated January 25, 1995.

The development of alternative LEC approaches clearly indicates that the definition and the corresponding policy issues. The Respondent in November 1992 stated in its response to 90-314 that the following should apply to disaggregation.

" IT IS RECOMMENDED THAT THE COMMISSION ALLOW THE LECs TO HAVE ACCESS TO PCN FREQUENCIES ON A BASIS THAT IS EQUAL TO ANY OTHER BIDDER, FOLLOWING THE BIDDING PROCESS THAT ALL OTHERS WILL ENTER INTO AND THAT THEY MUST, WITHIN NINETY DAYS AFTER THEIR WINNING ANY BID, SUBMIT, COMMIT, WARRANT AND GUARANTEE, TO ANY AND ALL OTHER ACCESS CONTENDERS, EQUAL AND EQUITABLE ACCESS AND PRICES TO ANY AND ALL UNBUNDLED ELEMENTS OF THE LEC NETWORK, INCLUDING BUT NOT LIMITED TO CO-LOCATION SWITCH ACCESS, CO-LOCATION FACILITIES ACCESS, ANDY ANY AND ALL OTHER UNBUNDLED ACCESS POINTS. IF ANY LEC, WINNING A BID, FAILS TO CONFORM TO THE POLICY, THEN IT LOSSES ITS BID AND FORFEITS IT BID FEE TO THE U.S. GOVERNMENT. "

The current market supports several entities, specifically:

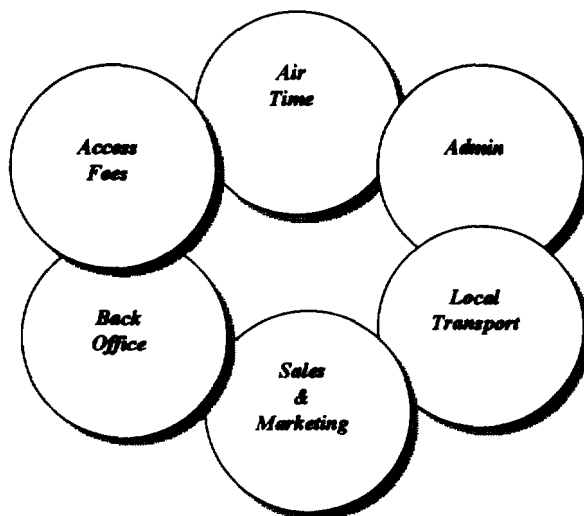
Local Exchange Carriers: The LEC is a provider of local exchange service. It appears that an operative element of the LEC provider is their delimitation to service provision within the confines of a single state and the lack of ability to transverse state boundaries. This definition is dated by the concepts present in the 1934 Federal Communications Act (the "1934 Act") and are supplanted by the new competitive environment of the 1996 Telecommunications Act (the "1996 Act"). Thus a LEC, in its broadest sense is an entity that provides access to the telecommunications networks directly to an end user. We argue that this broadened definition be employed.

CMRS Providers: The CMRS providers have been separated by the 1996 Act and this is further segmented by 332 definitions that assume the mobile nature is a defining characteristic.

Resellers and Agents: Resellers and Agents have for certain purposes been subsumed under the definition and aegis of the CMRS definition.

Disaggregators: This player is a key differentiation in the market. The Disaggregator is one who may use the existing license holders access facilities as one of several means to provide service to a fixed customer base. In WT 96-6 the Commission raises the issue of allowing the CMRS to provide fixed services. Namely this allows the CMRS, as defined by the Commission to be a purveyor of what is normally termed LEC services and for the purpose of WT 96-6 is called WLL. It is argued that the Disaggregator is a different entity altogether and more importantly it is argued that the disaggregator is the most likely evolutionary entity to change as full competition is presented in the wireless market.

The provision of wireless services is based upon the integration of the service elements shown in the following Figure. This shows the parts of the business from a functional perspective that must be provided.



The approach is a full disaggregation strategy for deployment of the business. Specifically the company may outsource services, buy airtime, contract sales, and would hold minor administrative duties unto itself. It means that a company can get into the business of providing local exchange services as well as mobile like services without holding a license. In fact it further can do so through the acquisition of intermediary transport vial wireless and terrestrial based suppliers. It is argued that this reseller business paradigm has been at the heart of the inter-exchange business during its first ten years of deregulation. The following Figure depicts the ability of the company to sell a service based upon the purchase of all of the elements.

This following Figure demonstrates what is actually happening to the industry. The key issue will be disaggregation of airtime. This can be done in four ways:

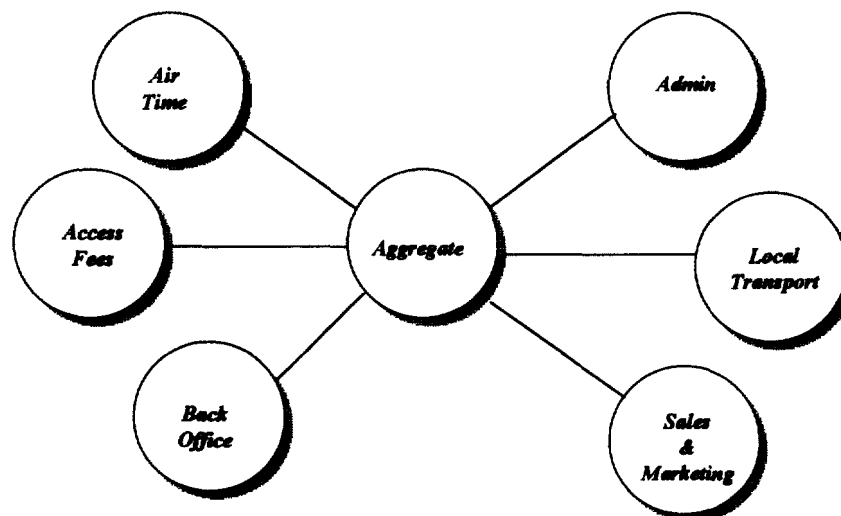
Type 1 "Buy Fully Integrated Minutes" : This is what is available to the current resellers. The CMRS, generally the duopolistic cellular company sells minutes of connect time from the customer to the RBOC LEC.

Type 2 "Disaggregated Minutes" : This is the sale of cellular minutes from the customer to the trunk side of the CMRS switch. It allows the competing LEC to sell service from

that point on and allows the competing carrier to become a Local Exchange Carrier in its own right and seek appropriate interconnect and access pricing agreement from the monopoly local exchange carrier, the RBOC.

Type 3 "DS1 Buys" : This is the purchase of DS1 or 24 voice channels from the cellular purveyor from the users to the trunk side of the CMRS switch. The new carrier takes the risk of loading these circuits up and then sell them. This is what is done today in the LEC market. It is mandated to LECs that are not CMRS by the 1996 Act but is not done so yet in this area of the CMRS. *Under this Docket, the Respondent sees that the Commission has the ability to join this issue and so mandate that the existing CMRS must unbundle the DS1 circuits and sell them to competing LECs.*

Type 4 "Spectrum Access" : This form of air time disaggregation is the most extreme. It allows, depending upon availability of spectrum, the purchaser to buy from the license holder, IF Bandwidth. Namely, the license holder will provide the transmitters and receivers at the sites but the buyer will provide all signaling behind this. This form has been advocated by several people in various forms before. The Respondent has commented on the Gilder Conjectures and this type of airtime is a way, under the 1996 Act, to begin implementation of this approach.¹⁰ This will especially be important in the context of the proliferation of spectrum with the completion of the PCS auctions.

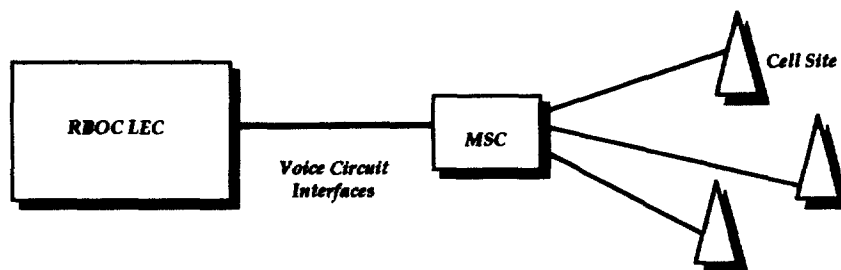


The AirTime strategy has three phases. They are:

¹⁰ See McGarty, TPRC September, 1994.

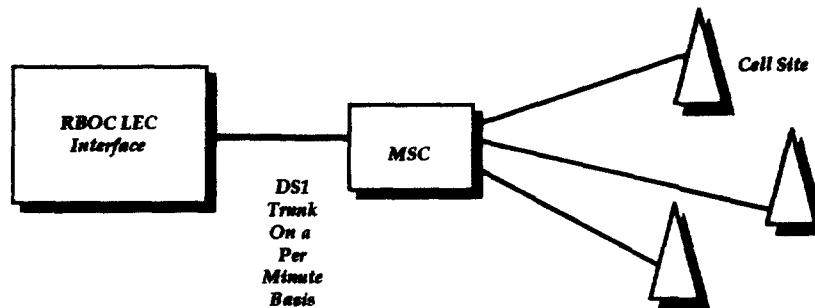
Type 1: Buy straight airtime at the standard reseller rates. These are generally at the range of \$0.20 per minute. This is as shown in the following Figure. This has already been discussed with the major cellular companies.

Proposal 1: Reseller Minutes



Type 2: In this proposal the company is to terminate on the MSC with a DS1 circuit and to have the connection from the Cellular carrier to the LEC be a competitor connection. This has been proposed to the Cellular companies and has yet to be accepted. It would reduce the rates to approximately \$0.18 to \$0.15 per minute. This is shown in the following Figure

Proposal 2: Common Carrier Minutes



COMAV, LLC

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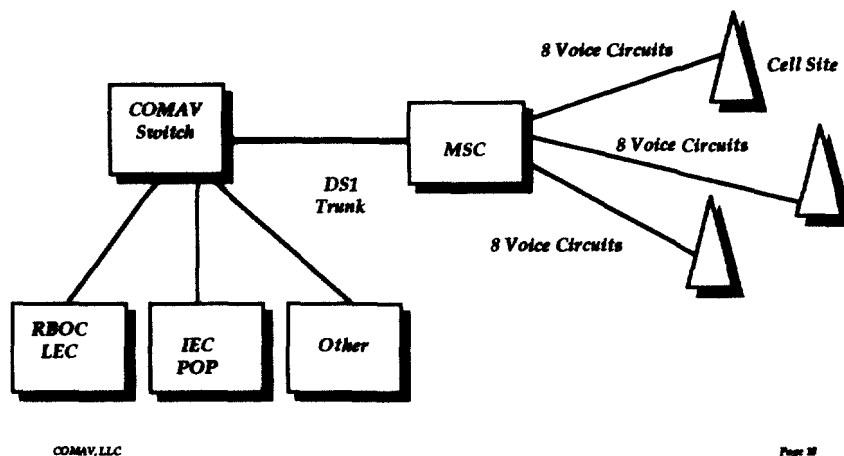
Type 3: This is the critical step that allows for success in local market competition and has been proposed under several other state dockets. What is being requested in this Phase is the purchase of a DS1 bank of voice channels. This is not a per minute rate, rather it is a buy of air time at risk. The competing carrier would take the risk of filing the channels with traffic. The following simple calculation how such an approach could be priced:

- *Cell Capital at about \$750,00 fully loaded per cell.*
- *In an analog system, 30 KHz per voice channel, 15 MHz per band, reuse of 7, yields $(15000/(30*7))$ or 72 instantaneous trunks per cell, or three DS1.*
- *The capital per DS1 is \$250,000.*
- *The lease rate for seven years at 18% annual interest is 2% per month or \$5,000 per DS1 per month.*
- *A user is busy 1% of the time at 100 minutes per month. Thus a DS1 can handle 2,400 users. That is \$2 per user per month.*
- *At 100 minutes per user this is \$0.02 per minute, a factor of 10 less than the Phase 1 Rates!*

- *If we further assume that there is a less than 100% loading and that the usage is less than 100%, and we use 50% in both cases, the effective rate per minute is \$0.08. It is this strategy that shows how one can achieve the result of expanding competition and in un-bundling.*

The following Figure depicts the architecture for the Type 3 air time access.

Proposal 3: DS1 Lease Rate



The new entity is a disaggregated entity and this entity can only be developed if the Commission utilizes its powers under the 1996 Act to treat the CMRS as any LEC and to apply the un-bundling requirements thereto.

The question then posed is the one that asks if this new disaggregated entity is itself a CMRS. Further, what is asked is the issue of whether this entity can compete with the LEC on the basis of a "Bill and Keep" or more preferably a "Zero Access" interconnect interface. Is there an "equal protection" issue here that states that the Disaggregator has rights that are *pari passu* with those of the CMRS or are that separate. We argue that the rights to access on a free and open basis convey without the position as LEC competitor and not merely as a CMRS. The Commission in WT 96-6 has joined this question.

3. WIRELESS LOCAL LOOP

The Commission seeks comment on their definition of Wireless Local Loop. Specifically:

*"Wireless Local loop as the path between the subscriber and the first point of switching or aggregation of traffic."*¹¹

The Respondent brings to the Commission attention the following facts¹²:

Fact 1: In CDMA as currently built and delivered by Qualcomm, the switching of all local network traffic is effected in the BTS, namely the cell site. The Base Station Controller and more importantly the Mobile Switching Center plays no role.

Fact 2: In the Qualcomm design and in other designs, there is no need for a switch based Mobile Switching Center. The system can use an ATM fabric and switching, as one knows it in a common Telephone company network, does not exist.

Fact 3: The concept of switching is changing dramatically as it is the concept of aggregation.

Fact 4: The voice in a CDMA network is packet and is generally indistinguishable from data.

Fact 5: The intelligence in the hand set is increasing dramatically and it is possible in the next generation of CDMA that the switching function may actually be there.

This begs the question as to whether there should even be a definition of a wireless local loop. The Respondent has used the term Wireless Local Loop ("WLL") as a euphemism for providing Local Exchange Services using primarily wireless means for local user interconnection as distinguished from a wireline carrier who uses copper or similar wire based systems exclusively. Thus, a WLL is some carrier who uses some wireless in some fashion, rather than copper, or its wire equivalent, in an exclusive fashion.

¹¹ ¶ 6 of WT 96-6 dated January 25, 1996.

¹² See McGarty, TPRC, September 1993 and 1994 for details on the architecture on Qualcomm equipment that allows this. Also see the Quarterly Reports from Telmarc to the Commission which detail all of the technical attributes that describe how this may be implemented. The original description was in the Telmarc Pioneer Preference filings from 1992 to the Commission.

The problem with the definition is that it is technologically unstable and policy wise un-useful. The Respondent takes the position that a WLL entity may use some wireless in the provision of a broad base telecommunications services. What is of the purview of the Commission would be the management of the RF parameters to ensure effective use of spectrum and allow the utilization be controlled by market forces.

4. CAPACITY OF BANDWIDTH: WIRELESS LOCAL LOOP

To effectively compare technological alternatives we must have models for the effective utilization of capital in the two cases. In this section we shall develop these models in summary form.

We assume that the system is composed of the following three generic elements;

Base Terminal Stations (BTS): These devices are placed in the field and there are as many BTSs as are need for either coverage or capacity. The first demand is coverage. A BTS may cover X square miles, depending on the power, the modulation, the multiple access, and the capabilities of the wireless end user terminal. For example, in CDMA with PCS, a BTS has three sectors, each sector covers three mile radius or about 33 sq. mi., for a total of 100 sq. mi. per BTS. If there are no customers, then for 1,000 sq. mi., one need approximately 10 BTS. A BTS also serves one or more CDMA channels. If it is a full band CDMA, at 100 MHz, then only one CDMA channel is needed at any time. If it is a narrow band CDMA, then the CDMA channels must be added each time the system load goes beyond the capacity of one link. Namely, in CDMA, a CDMA channel at 1.25 MHz service only 7 instantaneous channels or "trunks". Thus as the traffic increase, more CDMA channels must be added. Also in any system, trunk interfaces are added as the trunks are added, perforce of traffic growth.

Base Station Controllers (BSC): The BSC provides for the overall coordination and processing of the switched signals. It typically can handle a multiple set of BTSs and a multiple set of trunks. In the current CDMA narrowband system, a BSC handles up to 50 BTSs.

Switches (SW): The switch interfaces with the LECs and the IECs. It is sized based on a fixed component and a component dependent upon the number of trunks. Newer systems use ATM switching which has proven to be more efficient for the packet type voice signals integrated with data in a wireless environment.

The financial models for three cases using these models are presented below. The first models is for a narrowband CDMA system. It assumes that there are 1.25 MHz channels along with a total available spectrum as discussed above, and it assumes that the area covered is 1,000 sq. mi. The results show the capital per subscriber as a function of the total subscriber base. It should be noted that there is significant scale in the lower end.

Table: CDMA (1.25 MHz Channels)

| | | | | | | | |
|--|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|
| <i>Number of Subscribers</i> | <i>10,000</i> | <i>25,000</i> | <i>50,000</i> | <i>100,000</i> | <i>150,000</i> | <i>200,000</i> | <i>300,000</i> |
| <i>Total Area (sq mi)</i> | <i>1,000</i> | <i>1,000</i> | <i>1,000</i> | <i>1,000</i> | <i>1,000</i> | <i>1,000</i> | <i>1,000</i> |
| <i>No Sectors/BTS</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> |
| <i>Total Bandwidth (MHz)</i> | <i>15</i> | <i>15</i> | <i>15</i> | <i>15</i> | <i>15</i> | <i>15</i> | <i>15</i> |
| <i>Bandwidth/CDMA Channel</i> | <i>1.25</i> | <i>1.25</i> | <i>1.25</i> | <i>1.25</i> | <i>1.25</i> | <i>1.25</i> | <i>1.25</i> |
| <i>No CDMA Channels (Max/BTS)</i> | <i>12</i> | <i>12</i> | <i>12</i> | <i>12</i> | <i>12</i> | <i>12</i> | <i>12</i> |
| <i>Capacity/BTS (per CDMA Channel)</i> | <i>75</i> | <i>75</i> | <i>75</i> | <i>75</i> | <i>75</i> | <i>75</i> | <i>75</i> |
| <i>No BTS/BSC</i> | <i>50</i> | <i>50</i> | <i>50</i> | <i>50</i> | <i>50</i> | <i>50</i> | <i>50</i> |
| <i>Erlang Load/Customer</i> | <i>0.08</i> | <i>0.08</i> | <i>0.08</i> | <i>0.08</i> | <i>0.08</i> | <i>0.08</i> | <i>0.08</i> |
| <i>Number of Trunks</i> | <i>800</i> | <i>2,000</i> | <i>4,000</i> | <i>8,000</i> | <i>12,000</i> | <i>16,000</i> | <i>24,000</i> |
| <i>Radius/Cell Cluster</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> | <i>3</i> |
| <i>No Sectors</i> | <i>36</i> | <i>36</i> | <i>36</i> | <i>36</i> | <i>36</i> | <i>36</i> | <i>36</i> |
| <i>No BTS</i> | <i>13</i> | <i>13</i> | <i>13</i> | <i>13</i> | <i>14</i> | <i>18</i> | <i>27</i> |
| <i>No BSC</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> |
| <i>No CDMA Channels</i> | <i>13</i> | <i>13</i> | <i>13</i> | <i>13</i> | <i>14</i> | <i>18</i> | <i>27</i> |
| <i>No Trunks</i> | <i>800</i> | <i>2,000</i> | <i>4,000</i> | <i>8,000</i> | <i>12,000</i> | <i>16,000</i> | <i>24,000</i> |
| <i>No CDMA Channels/BTS</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> | <i>1</i> |
| <i>No Trunks/BTS</i> | <i>61</i> | <i>153</i> | <i>307</i> | <i>615</i> | <i>857</i> | <i>888</i> | <i>888</i> |
| <i>No Trunks/BSC</i> | <i>800</i> | <i>2,000</i> | <i>4,000</i> | <i>8,000</i> | <i>12,000</i> | <i>16,000</i> | <i>24,000</i> |
| <i>Maximum Subscribers (000)</i> | <i>158,438</i> | <i>158,438</i> | <i>158,438</i> | <i>158,438</i> | <i>183,750</i> | <i>303,750</i> | <i>683,438</i> |
| <i>Fixed Capital/BTS</i> | <i>\$8</i> | <i>\$8</i> | <i>\$8</i> | <i>\$8</i> | <i>\$8</i> | <i>\$8</i> | <i>\$8</i> |
| <i>Capital/Sector/BTS</i> | <i>\$18</i> | <i>\$18</i> | <i>\$18</i> | <i>\$18</i> | <i>\$18</i> | <i>\$18</i> | <i>\$18</i> |
| <i>Capital/CDMA Channel/BTS</i> | <i>\$85</i> | <i>\$85</i> | <i>\$85</i> | <i>\$85</i> | <i>\$85</i> | <i>\$85</i> | <i>\$85</i> |
| <i>Capital/Trunk/BTS</i> | <i>\$3</i> | <i>\$3</i> | <i>\$3</i> | <i>\$3</i> | <i>\$3</i> | <i>\$3</i> | <i>\$3</i> |
| <i>Fixed Capital/BSC</i> | <i>\$700</i> | <i>\$700</i> | <i>\$700</i> | <i>\$700</i> | <i>\$700</i> | <i>\$700</i> | <i>\$700</i> |
| <i>Capital/BTS/BSC</i> | <i>\$6</i> | <i>\$6</i> | <i>\$6</i> | <i>\$6</i> | <i>\$6</i> | <i>\$6</i> | <i>\$6</i> |
| <i>Capital/Trunk/BSC</i> | <i>\$1</i> | <i>\$1</i> | <i>\$1</i> | <i>\$1</i> | <i>\$1</i> | <i>\$1</i> | <i>\$1</i> |
| <i>BTS Capital</i> | <i>\$4,290</i> | <i>\$7,878</i> | <i>\$13,884</i> | <i>\$25,896</i> | <i>\$38,052</i> | <i>\$50,598</i> | <i>\$75,897</i> |
| <i>BSC Capital</i> | <i>\$1,578</i> | <i>\$2,778</i> | <i>\$4,778</i> | <i>\$8,778</i> | <i>\$12,784</i> | <i>\$16,808</i> | <i>\$24,862</i> |
| <i>Total Capital</i> | <i>\$5,868</i> | <i>\$10,656</i> | <i>\$18,662</i> | <i>\$34,674</i> | <i>\$50,836</i> | <i>\$67,406</i> | <i>\$100,759</i> |
| <i>Capital/Sub</i> | <i>\$587</i> | <i>\$426</i> | <i>\$373</i> | <i>\$347</i> | <i>\$339</i> | <i>\$337</i> | <i>\$336</i> |
| <i>Efficiency</i> | <i>6%</i> | <i>16%</i> | <i>32%</i> | <i>63%</i> | <i>82%</i> | <i>66%</i> | <i>44%</i> |

5. COVERAGE OF ALL CMRS

The Respondent seeks to clarify the terms provided in the NPRM issued by the Commission. Specifically there are two terms employed with some confusion; Local Exchange Carrier (LEC) and the Public Switched Telephone Network (PSTN). The Definitions suggested are as follows:

Definition: The *Local Exchange Carrier* is any local common carrier who provides end user access in a common carriage fashion, and provides local transport, switching, billing, and interconnections capabilities to other LECs.

Definition: LEC *Interconnection* is defined as the ability of one LEC to have access to any other LECs network via a set of open, defined, standard, stable and accessible interfaces for the purpose of providing communications parity between the two LEC networks.

Definition: The *Public Switched Telephone Network* (PSTN) is defined as the collection of all LEC and IEC networks, providing services on a common carriage basis and allowing mutually accessible interconnection capabilities amongst and between them.¹³

These definitions attempt to clarify a significant set of issues. First it is clear that the term LEC, as applied to the local Bell Operating Companies, BOCs, such as NYNEX, the old New York Telephone Company, NYT, cannot be solely applied as a term of art in the context of the new competitiveness permitted by PCS. Specifically all local companies, be they wire based on wireless are local exchange carriers. The issue is parity amongst LECs and not the need to establish a preferential treatment to the embedded monopoly player, the BOC.

The PSTN is an amalgam of such entities combined with the IECs and requiring further the need for interconnection. The terms *Co-Carrier* is comparable to that of LEC combined with open interconnect.¹⁴

¹³ NPRM 93-252, Para 22. The Commission has requested definition of the PSTN. The Respondent notes that such a definition requires a more detailed description at both the physical and logical levels. Also that the PSTN has been changed by technology and the ability to interconnect at all levels. Further, the distinction between voice, data, basic and enhanced is significantly blurred by the use of digital systems and especially multimedia environments.

¹⁴ It should be noted that Co-Carrier was a term coined by MFS in its filings before the New York State PSC in 1991 in an attempt to seek co-location. This term is rife with many problems and interpretations. The carriers should be all viewed as *pari passu* Local Exchange Carriers and the term Co-Carrier is almost a "separate but equal" interpretation that we argue is un-Constitutional.

The issue of common carriage is one driven by the nature of the offering.¹⁵ As a term of art, common carriage implies that the entity intends to offer its services to any and all comers at a publicly posted price per unit of service. Further, the entity will not discriminate amongst any entity that seeks to obtain service in those areas in which the purveyor offers such bundle of services. From a historical perspective, common carriage is embedded in English law allowing shipping firms to use public dock space in return for the commitment to offer to carry any cargo at listed prices. It did not preclude private shipping from firms at their own docks, located on property at their own land.

The Respondent argues that from the perspective of public policy, all PCS spectrum should be used in a common carriage fashion.

As has been argued in the previous section, that interconnections are provided through common, standard, stable, accessible interfaces. However, interconnection may be defined at two levels.¹⁶

Definition: *Physical Interconnection* is defined as the ability to connect any and all physical facilities from one local exchange carrier to another for the purpose of transferring in a free and ready fashion any and all electrical, electronic, or mechanical signals from one local exchange carrier to another.

Definition: *Logical Interconnection* is defined as the ability of one local exchange carrier and any other local exchange carrier or any other interexchange carrier to provide logic levels of access, via access to codes, data bases, signaling systems and points, operating systems, and control and management points in the network of all parties concerned, through stable, defined, standard, and accessible interfaces.¹⁷

¹⁵ Brenner, Law and Regulation of Common Carriers, Westview, 1992, pp. 35-37. The author states that the Act is ambiguous on common carriage. However, the author states that the statutory elements may be inferred as; engaged in communications, common by holding itself out to the public indiscriminately, a carrier in terms of control the means of transmission, for hire, not broadcasting. Furthermore, it should be noted that common carriage brings rights as well as responsibilities. It does not imply that common carriage is merely a burden.

¹⁶ Para. 14, NPRM 93-252. The Commission seeks to have the issue of interconnected service defined. The Respondent herein clarifies that Interconnected Service must be viewed as interconnect on many layers. Failure to address both will lead to near term difficulties. A Private Network may be one in which the operator provides wireless access to a closed community group, such as may be done through a public safety network, which is never interconnected to the Public Network. However, even in these circumstances, technology today allows interconnection of any network to any other, and the availability of such interconnection negates the concept of a Private Network.

¹⁷ McGarty, Alternative Networking Architectures, McGraw Hill, 1992; pp. 218-270. The author has developed architectural alternatives that demonstrate that the logical level of interconnection is of dominant interest as the new network architectures evolve. In the paper, McGarty & McGarty, Architectures et Structure de l'information; Reseaux, No. 56, Novembre, 1992; pp. 136-137, the authors

The distinction between the two is both essential and at the heart of the policy issue. Disallowal of interconnection at either level will tend to reduce the ability of any new entrant to gain services for the new entrants customer base, and such denial is a bottleneck and a barrier to entry. The physical interconnect relates to the many issues of co-location.

The logical issue will be at the heart of such issues as roaming, 800 data base access, SS7 database access, operator services, network management, billing, customer services and enhanced services provision. The issues reminiscent of the equal access concerns will dim in comparison to the logical interconnect issues in the world of PCS. The Respondent desires to point out to the Commission that such issues will go to the heart of new service provision as well as to the heart of cost competitiveness.

The issue of interconnect must also be viewed in the context of the overall network architecture. The Respondent has previously proposed, along with other, an architecture that allows for interconnection at the physical and logical level. The system architecture has been divided into several general classes. They are the national service infrastructure (NSI), the local service infrastructure (LSI), the service provider infrastructure, the Interexchange carrier elements, and the local exchange carrier elements, apart from those of the carrier at hand. They are interfaced at the local level and there is a national coverage requirement for the NSI to have overall management control over the national service.

There has been a significant amount of work done in developing a standard architecture for the provision of PCS Services, and the work has focused on PCS with the following goal in mind:

"Toll grade quality voice and data services, that are totally wireless in any environments, providing a seamless interoperable national network service."

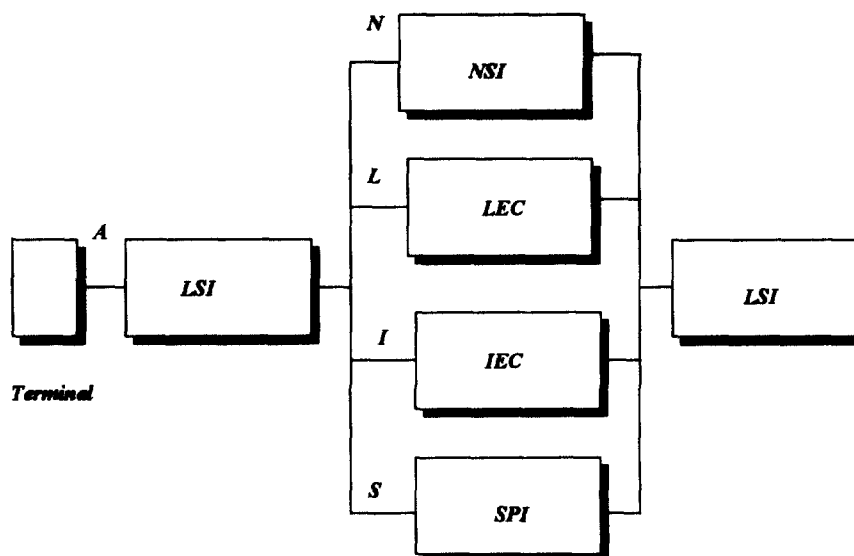
That is, the PCS paradigm used is that it is just a telephone and it happens to be wireless. The wireless requirement demands that it work in any terrestrial wireless mode, fixed or moving, inside or outside.

The Respondent has developed a generic architecture with elements that is shown in the Figure. The intent of the architecture is to demonstrate that the elements can have a

develop the concept of a logical infrastructure. This extends the concept of the physical infrastructure that is all too often the NII concept and is the basis of the Commission's thinking in interconnect. The Respondent requests that the Commission expand its definition to include such thinking in view of the evolution of technology and the network.

minimal set of functionality and that the interfaces can be open interfaces that can be established as standards. The architecture is shown below.

Figure: General Architecture and Standard Interface Elements



In this architecture we have identified five standard interfaces. They are as follows:

- **A Interface:** This is the air interface between the portable and the LSI. It is important to note that we have not taken and further broken down the air interface and introduced a local switch interface as has PCIA and Bellcore. The approach proposed here is more extensive than the PCIA approach by allowing more creative technological solutions to the local interconnect problem, as has been discussed elsewhere.
- **N Interface:** The N interface is the interface between the Local Service Infrastructure, LSI, and any and all other elements and the National Service Infrastructure. The National Service Infrastructure, NSI, supports such functions as Customer Care and Network Management which means managing all of the national network.
- **L Interface:** The LEC interface is defined as a toll tandem trunk interface. It is an interface that is standard to the LEC and is viewed as either an interoffice trunk or as an IEC trunk. It typically is formatted as a DS 3 with an SS 7 overlay.

- **I Interface:** The IEC interface is also in trunk format as with the L interface.
- **S Interface:** The Service Provider Interface needs further definition and development. One interface being developed is that interface at the S level for interfacing to the Internet for data purposes, voice mail interfaces, and general enhanced service platform interfaces.

These interfaces relate directly to both the physical and logical interconnect issues raised by the Commission.¹⁸ The Respondent concludes that both levels must be considered in the definition of interconnection.¹⁹

The Respondent argues that interconnect, both logical and physical must take all of the above elements into account. Moreover, the Respondent takes the position that the interconnects must be open, standards, stable and accessible.

There is a second issue on interconnect and that is the cost of the interconnect as viewed by the service provider. This is the issue of access fees, and the issue of the status of other LECs within the same market. Concomitant with that issue is that of who has regulatory control and authority over these entities. The Respondent will defer this issue to the next section.

Access policy has evolved over the past ten years in an environment pressured by competitive carriers and now with innovative technologies. A third dimension driven by new and innovative services will also effect the change in access. This Respondent reviews the issues of access and uses specific case studies to demonstrate the effects that access

¹⁸ Para 69, NPRM, 92-252. The Commission indicates that the legislation requires interconnection on a reasonable request. The Respondent argues that this itself is not adequate. The Respondent argues further that the process of establishing "reasonable requests" is rife with administrative delays. The Respondent requests that the Commission provides access on a free and open basis as herein defined at both the physical and logical levels. As noted, Section 201 of the Act already provides the Commission with such authority, but the Commission has managed such authority with administrative procedures that may delimit competitive process because of the delays and costs associated with the Administrative process. The Respondent hereby seeks to request that Commission has the authority in Section 201 to establish, and manage such interconnection procedures that result in free and open access.

¹⁹ NPRM 93-252, Para 18. The Commission uses the Part 22 definition of interconnection, focusing on Physical interconnect only. The Respondent argues that this is only one of the elements and that the logical interconnections bears more emphasis in light of the evolution of the network. The Commission in Para 19 raises the issue of Co-Carrier status and states "Part 22 providers are co-carriers to local exchange companies because they generally engaged in the provision of local intrastate, exchange telephone service." The Respondent notes that under its expended definition of a Local Exchange Carrier, that is any local carrier, all such carriers would and should have equal access to all elements necessary for service provision.

can have on the development of new and innovative telecommunications infrastructures. The primary focus is on the developments in Personal Communications Services, PCS, a new wireless service offering in the 1.8 to 2.2 GHz bands.

The Respondent has developed a set of detailed microeconomic models for the new infrastructure and shows that access can have a dominant role to play on its rapid acceptance. The Respondent has demonstrated that the infrastructure has limited scale and scope in its economies and that access fees and policy present potential bottlenecks to competing service providers.

In addition the Respondent reevaluated the basic economic tenets that are used in determining such things as sunk costs when such costs are not irrelevant in an environment that is rate base dominated. In such environments, the system has memory, and it is that memory that changes the basic economic tenets that we all accept so readily.

This Respondent further relies on developing the theory into policy by focusing on the current examples prevalent in wireless Personal Communications Services, PCS. In addition, the Respondent expands this into alternative access and INTERNET applications, although the focus is on PCS. The PCS focus is critical in that it is a technology that dramatically shifts the well understood paradigms that have shaped the world view of telecommunications.

PCS allows for the delivery of telecommunications in an environment where there is limited economies of scale and scope. To do this PCS takes advantage of technology, existing infrastructure and equity in access fees. It is the combination of these three elements that has allowed PCS to have a dramatic impact in the telecommunications competitive environment.

Current access fee structures are undergoing significant change. In this section, the Respondent presents a summary of the current structures and present some possible changes in tariff structures. For example, in the cellular world, there are agreements, specifically contracts, that have tariffs embedded in them. The Agreements go beyond or delimit the tariff. We shall reference in this Respondent several such tariffs between RBOCs and cellular carriers. In addition, these referenced tariffs further reference of the tariffs that have been in place in other areas of application. Thus it is not as simple as is first surmised.